



Catalysts of inclusive innovation: A multi-theoretical study of digital innovation hubs in Africa

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Orientation: Africa continues to face structural challenges, including youth unemployment, digital exclusion and fragmented innovation ecosystems. Digital innovation hubs (DIHs) have emerged as strategic platforms that bridge these gaps by supporting entrepreneurship and digital transformation.

Research purpose: This study investigated how DIHs act as catalysts of inclusive innovation and economic development in Africa using a multitheoretical framework.

Motivation for the study: Despite their expanding presence, limited scholarly work explores the role of DIHs within African innovation systems. This study addresses that gap by assessing their ecosystemic, institutional and developmental contributions across diverse contexts.

Research design, approach and method: A qualitative, exploratory research design was adopted. Semi-structured interviews were conducted with DIH managers and startup founders across 12 African DIHs affiliated with the African European Digital Innovation Bridge Network initiative. Thematic analysis was used to derive insights into their structure, function and influence.

Main findings: The study identified six thematic impact areas, namely startup empowerment, inclusive participation, ecosystem integration, transformative education, sustainability orientation and policy alignment. Digital innovation hubs serve not only as startup enablers but also as institutional anchors that facilitate knowledge exchange, derisk entrepreneurship, and expand access to digital tools and markets.

Practical/managerial implications: The DIHs should be supported through sustained investment, policy integration and inclusive programming. Their role as conveners of public-private collaboration positions them as key agents of development.

Contribution/value-add: By applying the Knowledge Spillover Theory of Entrepreneurship, Institutional Theory and Cluster Theory, this study offers a novel conceptual framing of DIHs in African contexts. It contributes empirical evidence and strategic insights for designing scalable and context-sensitive innovation ecosystems.

Keywords: digital innovation hubs; inclusive innovation; entrepreneurship ecosystems; knowledge spillover theory; institutional theory; cluster theory; startup development.

Introduction

Africa faces enduring challenges of high unemployment (Statistics South Africa [StatsSA] 2025), sluggish economic growth, inequality and limited entrepreneurial success among startups (Ndlovu et al. 2024; Weaich et al. 2024). Youth unemployment, in particular, poses a systemic threat to socio-economic stability (StatsSA 2025). In this context, entrepreneurship is increasingly recognised as a driver of economic transformation and social innovation (Ghura 2019; Gumbo & Moos 2024; Urbano, Aparicio & Audretsch 2019). Traditional incubators and accelerators, while widely adopted, have often proven insufficient to overcome the continent's systemic barriers, such as fragmented innovation systems, inadequate infrastructure and limited digital inclusion (Abrahams 2021; AfriLabs & Briter Bridges 2019; Friederici 2019). Against this backdrop, Digital Innovation Hubs (DIHs) have emerged as promising institutional mechanisms that integrate digital transformation with entrepreneurship support, providing collaborative platforms for start-ups, small businesses and innovators to access technical expertise, market linkages and funding (Crupi et al. 2020; Kalpaka et al. 2020).

The DIHs function as catalysts for startup growth; they support ideation, prototyping, market access and sustainable scaling (Gumbo & Moos 2024). They also offer physical infrastructure and digital tools essential for innovation in the Fourth Industrial Revolution (4IR). Through qualitative methods, the study highlights how DIHs influence development outcomes, including job creation, market entry, revenue generation and knowledge transfer.

Globally, DIHs have been positioned within Europe's Smart Specialisation Strategy and supported through frameworks such as Horizon 2020, where they have contributed to small to medium enterprise (SME) competitiveness and digital transition (Sassanelli et al. 2021). In Africa, DIHs are a relatively recent phenomenon but have gained traction in countries such as South Africa, Nigeria, Kenya and Rwanda. Evidence suggests that they contribute to entrepreneurial resilience, digital inclusion and job creation while addressing social challenges such as youth unemployment and gender exclusion (Atiase, Kolade & Liedong 2020; Lusweti & Omieno 2023). Yet, despite their growing prominence, research on DIHs in African contexts remains fragmented, often descriptive and largely focused on individual case studies rather than multicountry, theory-driven analyses (Vakirayi & Van Belle 2020).

Several knowledge gaps persist. Firstly, numerous DIH functions are recognised, such as 'test before invest', skills development and ecosystem networking (Kalpaka et al. 2020). However, little is known about how these functions interact to influence entrepreneurial activity and inclusive innovation outcomes in Africa. Secondly, the literature has not sufficiently examined DIHs through integrated theoretical lenses that capture both institutional and ecosystemic dimensions of their impact. Thirdly, existing studies rarely address the extent to which DIHs can act as hybrid institutions that simultaneously support digital entrepreneurship, policy alignment and social transformation across diverse African contexts. These gaps restrict both scholarly understanding and policy design at a time when DIHs are increasingly invoked in regional development strategies.

This study addresses these gaps by examining how DIHs operate as catalysts of inclusive innovation across 12 African hubs affiliated with the African European Digital Innovation Bridge Network (AEDIBNet) initiative. Using a qualitative, exploratory design, it applies the Knowledge Spillover Theory of Entrepreneurship (KSTE), Institutional Theory and Cluster Theory to develop a multitheoretical understanding of DIHs as ecosystemic actors. In doing so, the study not only provides empirical insights into the structural and developmental roles of DIHs but also extends theoretical debates by demonstrating how DIHs adapt and evolve in African contexts. The contribution lies in positioning DIHs as more than digital support centres. Moreover, they are institutional anchors that integrate diverse functions to foster entrepreneurship, reduce structural barriers and stimulate inclusive economic growth.

Research objectives

This study is guided by three key objectives. Firstly, it aims to analyse how DIHs integrate multi- and inter-disciplinary approaches (such as business development, digital technology, education and policy) to foster entrepreneurship across African innovation ecosystems. By bringing together these diverse domains, DIHs serve as collaborative platforms that address complex socio-economic challenges faced by startups and SMEs. Secondly, the study seeks to evaluate DIHs as models for economic growth and development, particularly in how they facilitate access to finance, skills, prototyping infrastructure and market linkages that accelerate business viability and scale. Thirdly, the research aims to propose actionable strategies for scaling the impact of DIHs across varied African economies. This includes recommendations on policy alignment, regional integration, public-private partnerships (PPPs) and inclusive design to ensure that DIHs remain sustainable, accessible and transformative across the continent.

Literature review

Digital innovation hubs are increasingly recognised as strategic enablers of digital entrepreneurship and economic resilience. Their global emergence is rooted in Europe's 'Smart Specialisation Strategy', which introduced DIHs as multifunctional platforms supporting SMEs in digital transitions (Crupi et al. 2020; Kalpaka et al. 2020). As evidenced in Finland and Spain, by integrating technology testing, training, finance access and ecosystem networking, DIHs have proven to be effective in enhancing SME competitiveness and regional innovation systems (Haukipuro et al. 2023; Sassanelli et al. 2021). In North America and Asia, similar hubs support sectoral acceleration in medtech and agritech, confirming DIHs' adaptability across diverse geographies.

In Africa, DIHs have emerged as critical platforms bridging gaps in digital infrastructure, entrepreneurial education and innovation finance. Countries such as South Africa, Kenya, Nigeria and Rwanda have adopted DIH-inspired models to drive inclusive digital transformation. Notable examples include Tshimologong Precinct and Rwanda's Information and Communication Technology (ICT) Innovation Hub, which have fostered digital startups, youth skills and industry-academia collaboration (Abrahams 2021; Rudawska 2022). Empirical studies confirm their contributions to job creation, knowledge transfer and startup resilience, reflecting a localised hybridisation of European models adapted to African socio-economic priorities (AfriLabs & Briter Bridges 2019; Atiase et al. 2020; Gumbo & Moos 2024).

Studies across Africa and Europe converge on four foundational DIH pillars, namely test before invest, skills and training, access to finance and ecosystem networking (Asplund, Macedo & Sassanelli 2021; Crupi et al. 2020; Kalpaka et al. 2020; Rudawska 2022; Sassanelli et al. 2021; Zamiri et al. 2021). European DIHs benefit from strong policy

frameworks and instruments such as Horizon 2020 (AEDIBNet 2022; Rudawska 2022). African hubs often rely on donor funding, government grants and programmes such as AEDIBNet (AfriLabs & Briter Bridges 2019; Atiase et al. 2020). While different, both ecosystems report enhanced entrepreneurial activity, lower failure rates and improved market access (Crupi et al. 2020).

Increasingly, African literature positions DIHs as social innovation catalysts addressing youth unemployment and digital exclusion (Abrahams 2020; Hammond et al. 2020; Herrington & Coduras 2019; Jiménez & Zheng 2021). Examples from Nigeria and Kenya show DIHs supporting not only tech startups but also creative industries and social enterprises, with Kenya's iHub playing a pioneering role in digital empowerment (Friederici 2019; Lusweti & Omieno 2023). Similarly, five case studies across Nigeria, South Africa, Kenya and Uganda reveal DIHs' significant social value in job creation, capacity building and community development (Atiase et al. 2020). In Tanzania, Mwantimwa et al. (2021) have observed that innovation hubs contribute to enterprise development, social inclusivity and knowledge exchange by creating platforms that engage marginalised groups. Building on these insights, this study conceptualises DIHs as hybrid institutional mechanisms that combine business acceleration with social transformation through incubation, mentoring and collaborative knowledge creation.

While this study focuses on Africa, parallels with the Global North suggest DIHs foster entrepreneurship in underserved communities and act as engines for digital inclusion, especially in contexts of youth unemployment and digital divides (AfriLabs & Briter Bridges 2019; Jiménez & Zheng 2021). However, challenges remain, including weak national innovation systems, fragmented policy implementation and over-reliance on short-term funding (Atiase et al. 2020; Mwantimwa et al. 2021). Globally, concerns include technology lock-in and exclusionary DIH frameworks that risk neglecting local capacities (Guckenbiehl & Corral de Zubielqui 2022; Hillemane Satyanarayana & Chandrashekar 2019). These underscore the need to localise DIH models to ensure sustainable and equitable outcomes in the Global South.

Lastly, scholars highlight the need for robust DIH evaluation mechanisms. Despite anecdotal success, gaps remain in metrics capturing long-term outcomes, such as startup survival and economic impact (Mhlongo & Mzyece 2023; Mrkajic 2017). In Europe, Hervás Oliver et al. (2021) also stress embedding stronger performance monitoring within DIH programmes. Over-reliance on basic indicators, such as job creation, oversimplifies DIHs' nuanced roles. Scholars advocate for customised key performance indicators (KPIs) reflecting business growth, innovation outputs and community transformation (Kalpaka et al. 2020; Madaleno et al. 2022; Rudawska 2022; Spigel & Harrison 2018). These enable DIHs to demonstrate accountability and scale their impact more effectively.

Conceptual foundation and theoretical framing

This study is anchored in three interconnected theoretical frameworks. These are the KSTE, Institutional Theory and Cluster Theory.

Knowledge spillover theory of entrepreneurship

The KSTE posits that unintended knowledge diffusion fuels entrepreneurial activity by enabling individuals and organisations to build on innovations they did not originally create (Acs et al. 2009). Traditionally facilitated by geographic proximity and informal exchanges within industrial clusters, these processes are amplified in DIHs through digital technologies, structured programming and institutional partnerships. The DIHs create knowledge-rich environments where startups benefit from co-location, collaboration and curated learning through workshops, hackathons and online repositories. Digital tools such as virtual platforms and cloud environments extend these spillovers beyond physical proximity, accelerating knowledge flows (Ferreira, Ratten & Dana 2017; Madaleno et al. 2022). This study highlights three mechanisms through which DIHs enhance spillovers, namely cross-fertilisation of ideas, derisked innovation and collaborative learning spaces. By fostering collaboration among startups, academia and corporates, DIHs stimulate new product development and inter-sectoral knowledge transfer (Braunerhjelm, Ding & Thulin 2018). They also provide access to research facilities and mentorship that reduce innovation costs and uncertainties (Audretsch, Belitski & Caiazza 2021). Structured programmes, such as accelerators and peer exchanges, further reinforce iterative knowledge loops, strengthening entrepreneurial capabilities (Shu et al. 2020).

The study also extends the theory by underscoring the significance of unintentional knowledge diffusion within DIHs. Informal sharing occurs through co-working spaces and mentor interactions, which aligns with Block, Thurik and Zhou's (2013) assertion that knowledge benefits others without direct compensation. Moreover, DIHs are formalising mechanisms to measure spillover effects using KPIs such as joint venture formations and collaboration indices to track knowledge transfer in digital contexts (Ferreira et al. 2017; Kalpaka et al. 2020; Sassanelli et al. 2021). The KSTE remains central to understanding DIHs' role in Africa's digital economy, where digital platforms and data sharing tools replicate the benefits of physical clusters (Ferreira et al. 2017; Porter 2000). Embedding this framework in Africa's maturing innovation systems illustrates how DIHs can catalyse inclusive economic development by enhancing innovation capacity and knowledge-based inclusion in underserved regions (Dheer 2017; DiMaggio & Powell 1983).

Institutional theory

Institutional Theory offers a valuable lens for understanding how DIHs shape entrepreneurial activity by influencing the

norms, structures and behaviours startups adopt to gain legitimacy (DiMaggio & Powell 1983). Within DIHs, these institutional forces are operationalised through formal support structures such as mentorship, digital training, funding access and policy-aligned initiatives that collectively reduce startup risk and enhance legitimacy (Covin & Miller 2014; Dubey et al. 2019).

The theory further highlights mimetic isomorphism, wherein startups strategically emulate successful peers to gain validation and market acceptance (Covin & Miller 2014). This is particularly relevant in African contexts, where informal entrepreneurial pathways dominate and alignment with prevailing hub practices fosters trust and legitimacy (Dheer 2017). The DIHs also serve as socio-organisational anchors, embedding dominant business models while lowering entry barriers for underrepresented groups such as youth and women (Glynn & D'ainno 2023; Van Wijk et al. 2019). Moreover, digital mechanisms such as online mentorship, virtual demo days and automated services extend institutional support beyond geographic boundaries, creating new forms of legitimacy through digital competence and engagement (Ferreira et al. 2017).

Although Institutional Theory has been critiqued for neglecting power dynamics, this study recognises the varying influence of stakeholders such as funders, corporates, academia and governments within DIHs (Aksom 2023; Drori 2019). Effective hubs mitigate these dynamics by fostering inclusive, transparent and multistakeholder governance structures. Thus, DIHs are positioned not merely as innovation spaces but as evolving institutions that legitimise, sustain and connect entrepreneurial ecosystems, bridging informal and formal economies and enabling startups to navigate complex regulatory and financial landscapes (David, Tolbert & Boghossian 2019; DiMaggio & Powell 1983; Dubey et al. 2019).

Cluster theory

Originally advanced by Marshall (1961) and later by Porter (1990, 2000), Cluster Theory posits that geographic concentration of firms fosters innovation, efficiency and competitiveness through shared infrastructure, workforce and informal knowledge exchange. The DIHs embody this principle by functioning as spatial and functional clusters for entrepreneurial development, offering shared services such as internet access, labs, co-working spaces and advisory support, which lower entry costs, encourage collaboration and foster early-stage innovation (Madaleno et al. 2022; Spigel & Harrison 2018).

This study extends Cluster Theory by highlighting digital clustering, where DIHs leverage digital platforms, remote collaboration tools and online training to replicate the benefits of physical proximity, particularly relevant in Africa's dispersed geographies. The DIHs also act as microclusters embedded within broader regional innovation systems, linking startups to universities, investors and global

partners, thereby amplifying local capabilities (Rudawska 2022; Zamiri et al. 2021).

Traditional cluster models have been critiqued for a narrow economic focus (Bathelt, Malmberg & Maskell 2004). However, DIHs adopt a more holistic approach by supporting social entrepreneurs and creative industries alongside tech startups, integrating social innovation and community engagement. However, the study also acknowledges inclusivity challenges within clustering, urging DIHs to actively ensure that benefits extend beyond elite actors through targeted outreach and support for underserved groups.

Thus, DIHs advance Cluster Theory by integrating digital infrastructure, broadening co-location concepts and embedding inclusive clustering strategies. They emerge as critical innovation nodes driving regional competitiveness, cross-sectoral collaboration and systemic entrepreneurial growth.

Research methods and design

This study adopted a qualitative research design anchored in a social constructivist ontology and an interpretivist epistemology. The choice of a qualitative approach was informed by the need to explore the subjective experiences of participants and capture the complex, context-specific mechanisms through which DIHs influence entrepreneurial activity. Semi-structured interviews were employed to generate rich, narrative data that enabled the identification of patterns, divergences and nuanced insights across different African contexts.

Population and sampling

The study population comprised DIH managers and startup founders with direct experience in DIH ecosystems. To ensure diversity in geographic representation and functionality, purposive sampling was employed. The study focused on the 12 inaugural DIHs established under the AEDIBNet, which span nine African countries, namely South Africa, Senegal, the Republic of Côte d'Ivoire, Cameroon, Tanzania, Tunisia, Egypt, Kenya and Rwanda. These hubs were selected because of their early role in piloting DIH models on the continent, thereby offering a valuable empirical base for exploring their developmental impact.

For DIH managers, one representative per DIH was targeted; thus, 12 managers were invited and six were interviewed (50% participation), with non-participation largely because of hubs still being established or not yet operational. For startup founders, the sampling frame comprised entrepreneurs affiliated with the only DIH in South Africa, selected because it is one of the AEDIBNet DIHs and because it provided easy accessibility. From a targeted sample of 79 founders, 28 interviews were completed (35% participation). A total of 11 invitations bounced, and the remainder did not respond, likely because of business closures or personal choice.

Data collection

Data were collected using semi-structured interview guides tailored to each participant group. The manager guide focused on hub design, governance, functions and ecosystem engagement, while the entrepreneur guide emphasised experiences of support, challenges and perceived impact of DIHs on business growth. Interviews were conducted between March and September 2023 on the virtual Zoom platform. Each interview lasted between 45 and 60 min and was audio recorded with participants' consent.

Data analysis

The interviews were transcribed and analysed manually using Braun and Clarke's (2006) six-phase thematic analysis framework. As such, initial coding was conducted in spreadsheets to capture recurring ideas, which were then clustered into themes and sub-themes through iterative review and refinement. The emerging themes were compared against the study's theoretical lenses (KSTE, Institutional Theory and Cluster Theory) to ensure analytical alignment. Trustworthiness was enhanced through peer debriefing and reflexive methods, which helped to validate coding decisions and strengthen the credibility of interpretations.

Trustworthiness

To ensure rigour, the study applied the four criteria of trustworthiness. These are: (1) credibility; (2) transferability; (3) dependability; and (4) confirmability. Credibility was supported by triangulating managers' and entrepreneurs' perspectives, while transferability was facilitated by providing detailed contextual descriptions. Dependability was enhanced by maintaining an audit trail of coding decisions and confirmability was achieved through reflexive journaling and peer debriefing.

Ethical considerations

Ethical approval for this study was granted by the Research Ethics Committee of the University of Pretoria on 13 March 2023. The ethical clearance number is EMS236/22. All participants provided written informed consent before their involvement in the research. To ensure the confidentiality and anonymity of participants, no identifying information such as names, affiliations or specific locations was disclosed in any part of the data analysis or reporting. Data were securely stored in password-protected digital files accessible only to the researcher. Ethical standards were upheld throughout all phases of the research before, during and after data collection; there was a continuous commitment to protecting the dignity, privacy and voluntary participation of all respondents. This reflects a comprehensive and ongoing application of ethical research principles beyond mere procedural compliance.

Results

Participants' demographics

The study included 34 participants, as mentioned. These included six DIH managers drawn from the 12 inaugural AEDIBNet hubs across nine African countries and 28 startup founders affiliated with the only hub in South Africa under the AEDIBNet. The managers (coded M1–M6) were responsible for designing and implementing hub activities, with professional backgrounds spanning ICT, entrepreneurship support and policy coordination, and an average of more than 5 years of experience in innovation ecosystems. The entrepreneurs (coded E1–E28) reflected diversity in gender, education, and sectors such as fintech, agritech and creative industries, with between 1 and 6 years in business. Demographic and professional details are summarised in Table 1 and Table 2, and this coding system is applied throughout the results section to attribute perspectives and illustrative quotations. The profiles highlight inclusivity, particularly in legitimising the participation of youth and women, while also revealing the uneven yet promising pathways of African startups, where early fragility coexists with signs of resilience and growth potential.

Table 1 and Table 2 present the demographic and professional profiles of the study participants. The six DIH managers (M1–M6) were relatively young but professionally qualified, with most holding postgraduate degrees, and represented a balanced gender mix across diverse national contexts. Their backgrounds in ICT, entrepreneurship support and policy underscore the professionalisation of African DIHs and the growing diversity in hub leadership. In contrast, the 28 entrepreneurs (E1–E28) displayed greater variation, ranging from early-stage founders with no employees and negligible revenues to more established ventures employing multimember teams and generating annual revenues above ZAR500 000.00, with one exceeding ZAR2 million. These contrasts illustrate both the fragility and the growth potential of African startups, while also highlighting the inclusivity of DIHs in legitimising the participation of youth and women. Taken together, these profiles establish the foundation for the thematic findings that follow, which draw on the coded perspectives of managers and entrepreneurs to illustrate the catalytic role of DIHs in shaping entrepreneurial activity.

TABLE 1: Profile of digital innovation hubs and programme manager participants.

Participant code	Age (years)	Country	Gender	Population group	Highest education qualification
M1	30–39	Kenya	M	Black people	Bachelor's degree
M2	18–29	Tanzania	M	Black people	Master's degree
M3	18–29	Rwanda	M	Black people	Bachelor's degree
M4	40–49	South Africa	F	Coloured people	Master's degree
M5	40–49	Egypt	F	Black people	Honours' degree
M6	30–39	Kenya	F	Black people	Master's degree

M, male; F, female.

TABLE 2: Profile of entrepreneur and/or start-up founder participants.

Participant code	Age (years)	Gender	Population group	Highest education qualification	Employment status	Years since founding startup	Number of employees in the startup	Annual revenue in the startup (ZAR)
E1	30–39	M	Black people	National diploma	Full-time entrepreneur	3–4	2–3	0–200 000
E2	30–39	M	Black people	Doctorate	Part-time employment	1–2	0	0
E3	18–29	M	Black people	National diploma	Full-time employment	5+	5–9	1 001 000–1 500 000
E4	18–29	M	Black people	Masters' degree	Full-time entrepreneur	2–4	5–9	501 000–1 000 000
E5	30–39	M	Black people	Bachelors' degree	Full-time entrepreneur	1–2	0	0
E6	18–29	M	Black people	Bachelors' degree	Full-time entrepreneur	2–4	5–9	201 000–500 000
E7	18–29	F	Black people	Bachelors' degree	Full-time entrepreneur	1–2	0	0
E8	40–49	M	White people	Honours' degree	Full-time entrepreneur	<1	0	201 000–500 000
E9	18–29	M	Black people	Honours' degree	Full-time entrepreneur	5+	5–9	501 000–1 000 000
E10	30–39	M	Black people	Bachelors' degree	Full-time entrepreneur	5+	0	0
E11	50–59	M	Black people	Honours' degree	Full-time entrepreneur	5+	5–9	0–200 000
E12	30–39	F	Black people	Bachelors' degree	Full-time entrepreneur	5+	10+	501 000–1 000 000
E13	30–39	F	Black people	Honours' degree	Full-time entrepreneur	2–4	2–3	501 000–1 000 000
E14	40–49	F	Black people	National diploma	Full-time entrepreneur	5+	5–9	0–200 000
E15	50–59	M	Indian people	Honours' degree	Full-time entrepreneur	2–4	0	201 000–500 000
E16	30–39	M	Black people	National diploma	Full-time entrepreneur	5+	5–9	0
E17	18–29	F	Black people	Masters' degree	Part-time employment	1–2	0	0
E18	30–29	M	Black people	Bachelors' degree	Full-time employment	5+	0	0–500 000
E19	30–39	M	Black people	Matric	Full-time entrepreneur	5+	1	501 000–1 000 000
E20	30–39	M	Black people	Masters' degree	Part-time employment	1–2	0	0
E21	50–59	F	Black people	Masters' degree	Full-time entrepreneur	5+	5–9	501 000–1 000 000
E22	30–39	M	Black people	National diploma	Part-time employment	5+	0	0
E23	30–39	F	Black people	Matric	Full-time entrepreneur	2–4	2–3	201 000–500 000
E24	30–39	M	Indian people	Masters' degree	Full-time entrepreneur	2–4	10+	2 000 000+
E25	40–49	F	Black people	Doctorate	Part-time employment	1	0	0
E26	30–39	F	Black people	Honours' degree	Full-time employment	1–2	0	0
E27	40–49	M	Black people	Bachelors' degree	Full-time entrepreneur	1–2	0	0
E28	30–39	F	Black people	National diploma	Full-time employment	1–2	0	0

ZAR, South African Rands; M, male; F, female.

Thematic findings

The analysis revealed six interrelated pillars of impact that collectively illustrate how DIHs catalyse inclusive and sustainable innovation across African contexts. These pillars include: (1) startup empowerment; (2) inclusive economies; (3) ecosystem integration; (4) transformative education; (5) sustainability practices; and (6) policy alignment. They represent the multidimensional outcomes of DIH activity. Together, they depict DIHs as adaptive institutional infrastructures that nurture entrepreneurial capability, bridge opportunity gaps and embed innovation within broader developmental systems. The sections that follow unpack each of these thematic pillars. The subsections will show how DIHs extend beyond their technical functions to operate as catalysts of entrepreneurial transformation, social inclusion and systemic ecosystem strengthening across diverse African environments.

Entrepreneurship development and startup empowerment

Across the 12 AEDIBNet DIHs, startups consistently reported enhanced capacities in product development, digital skills acquisition and business preparedness compared to their experiences before joining the hubs or operating independently. Entrepreneurs described how participation in DIH programmes exposed them to structured mentorship, collaborative innovation spaces,

and access to digital tools that had previously been unavailable. This enabled them to refine products, strengthen market strategies, and improve operational efficiency. By providing critical services such as testing and prototyping facilities, DIHs effectively reduced time-to-market for digital innovations, thus operationalising the 'test before invest' function that facilitates risk-mitigated innovation processes (Crupi et al. 2020; Kalpaka et al. 2020). One startup founder noted:

'access to mentors and industry experts has dramatically sped up our development cycle and reduced time-to-market.' (E25)

Access to technical infrastructure and software validation platforms further empowered early-stage ventures to refine their offerings before pursuing external investment. From the managerial perspective, DIHs were seen as foundational in this process, with one manager stating:

'DIHs play a huge role in how startups can get into the economy. My thinking has always been around how do we quicken startups' ability to start a company?' (M1)

These findings extend existing scholarship by offering empirically grounded evidence from the African context. This illustrates how DIHs serve as critical enablers of startup empowerment through structured, resource-rich environments that accelerate innovation readiness and derisk early-stage entrepreneurship.

Inclusive economies and capacity bridging

Digital innovation hubs have expanded inclusivity within African innovation ecosystems by deliberately targeting marginalised groups, particularly youth and women. Through mentorship, digital skills training and tailored incubation programmes, these hubs not only increase participation but also build the entrepreneurial confidence and capacity of groups historically excluded from innovation spaces. This demonstrates how DIHs act as equalising mechanisms that translate digital opportunity into tangible economic participation. As one startup founder emphasised:

‘DIHs gave me the confidence to move forward as a female entrepreneur in a space where I always felt overlooked. The mentorship and community made me feel I belong.’ (E18)

This reflects findings by Stojanova et al. (2022), specifically that DIHs promote equitable access to digital tools and training, especially in under-resourced communities. Digital innovation hubs managers also recognised this inclusive role, with one noting:

‘we see our hub as a safe space, especially for young people and women who traditionally have not seen themselves as tech entrepreneurs.’ (M2)

The collaborative setup of DIHs with mentorship, community events and stakeholder partnerships has reduced barriers to entry and helped create a culture of shared entrepreneurial growth.

Economic growth through ecosystem integration

Digital innovation hubs function as integrative ecosystems that connect entrepreneurs with funders, industry experts and research institutions. As one founder explained:

‘[T]he mentoring and business development services we received have been crucial for our growth, but it’s the introductions to funders and partners that really opened doors we couldn’t access before.’ (E10)

Sassanelli et al. (2021) highlight that DIHs help scale ventures through investment support and acceleration activities, while ecosystem brokerage creates new business-to-business linkages (Kalpaka et al. 2020). Echoing this, a DIH manager stated:

‘our ecosystem integration efforts focus on connecting startups with government bodies and large corporations, which can often be a game changer for young enterprises seeking to scale quickly.’ (M4)

These interventions contribute not only to increased revenue generation and employment among participating startups but also position DIHs as essential brokers of strategic partnerships and market access within Africa’s dynamic innovation landscape.

Transformative education and academic partnerships

Education remains central to DIH operations. Several DIHs collaborate with universities to co-develop entrepreneurship

modules, host hackathons and deliver practical business training (Kalpaka et al. 2020; Rowan et al. 2022). As one DIH manager remarked:

‘we collaborate closely with a university to run programmes that expose students to real-world entrepreneurial challenges, blending theory with practice.’ (M3)

A startup founder reflected this impact:

‘the training sessions helped us to better understand not just business models but how to pitch and present our solutions to investors and customers.’ (E15)

These findings demonstrate that DIHs are not only spaces for venture development but also play a critical role in advancing practice-based entrepreneurship education and fostering cross-sector knowledge exchange.

Sustainability practices and strategic orientation

Several DIHs embed sustainability principles into their operational and programming frameworks. Initiatives such as green technology programmes, climate-focused startup tracks and circular economy workshops are becoming more common. As one DIH manager opined:

‘we believe DIHs should be champions of sustainable and responsible innovation.’ (M4)

This aligns with observations by Kalpaka et al. (2020), who advocate for DIHs to be instruments of both digital and social transformation. The results also show that DIHs are aligning with broader development agendas such as the sustainable development goals (SDGs) and the African Continental Free Trade Area (AfCFTA). The DIHs, therefore, support ventures that tackle real-world problems such as climate change, food insecurity and health inequities. A startup founder reflected this shift, stating:

‘the hub has helped us think beyond profits. They challenged us to design our solution to also address community issues.’ (E19)

These findings confirm the emerging strategic role of DIHs in positioning entrepreneurship as a vehicle for inclusive, sustainable development, while anchoring startup activities within broader socio-economic transformation agendas.

Policy alignment and public-private collaboration

Digital innovation hubs are increasingly recognised as pivotal intermediaries in Africa’s evolving policy and innovation ecosystems. A DIH manager highlighted this dual positioning:

‘we see ourselves not just as service providers but also as ecosystem conveners that bridge government, industry and entrepreneurs to influence digital policy.’ (M1)

Governments can leverage DIHs to drive national digital strategies, while DIHs play a catalytic role in fostering policy dialogues that ensure inclusive innovation. From the

TABLE 3: A summary of the study's findings.

Key theme	Key findings
Entrepreneurship development and startup empowerment	Faster time-to-market, improved investor readiness and digital upskilling
Inclusive economies and capacity bridging	Gender-inclusive programmes, support for youth and underserved entrepreneurs
Economic growth through ecosystem integration	Funding facilitation, business-to-business linkages and local supply chain stimulation
Transformative education and academic partnerships	Co-designed curricula, hackathons and experiential entrepreneurship training
Sustainability practices and strategic orientation	Green innovation challenges, circular economy and ethics-focused ventures
Policy alignment and public-private collaboration	Government collaboration, policy forums, AfCFTA implementation

AfCFTA, African continental free trade area.

entrepreneur's perspective, DIHs are seen as key enablers in navigating regulatory barriers, as one founder stated:

'DIHs helped us understand the complex policies that impact our startups.' (E5)

These findings affirm that DIHs are emerging as strategic policy actors and brokers of public-private collaboration, reinforcing their capacity to drive systemic and structural change in Africa's digital economy.

Table 3 presents a synthesised summary of the study's key findings. It captures the multidimensional impact of DIHs across six core areas, ranging from entrepreneurship development to policy alignment. Each theme illustrates how DIHs contribute to inclusive innovation, economic growth and institutional transformation within Africa's evolving digital landscape.

Table 3 highlights DIHs' interconnected roles as innovation enablers and ecosystem builders, where efforts in entrepreneurship development, job creation and digital upskilling are intricately linked to advancing social equity, particularly for youth and women. Their integration with academia fosters experiential learning, while interventions in funding access and policy alignment amplify macroeconomic impact.

These outcomes are mutually reinforcing, positioning DIHs as pivotal drivers of systemic and sustainable transformation in Africa. The following discussion unpacks why this positioning matters, examining how DIHs translate their multifaceted functions into enduring developmental and entrepreneurial outcomes.

Discussion

This study illustrated the emerging role of DIHs in advancing entrepreneurship development and inclusive economic growth across Africa. Positioned at the intersection of business support, digital access and institutional innovation, DIHs provide integrated platforms that enable early-stage ventures to progress through 'test before invest' models, digital upskilling and market facilitation (Gumbo & Moos 2024). These findings corroborated earlier work framing DIHs as one-stop hubs that derisk and legitimise startup activity through

infrastructure, mentorship and funding pipelines (Kalpaka et al. 2020; Sassanelli et al. 2021). At the same time, the results extended this literature by showing that African DIHs embed digitalisation into startup support more deeply than traditional incubators, highlighting their hybrid role as both innovation accelerators and socio-institutional anchors.

Beyond economic functions, the study underscored DIHs' contribution to social innovation, particularly in legitimising the participation of youth and women. This aligned with evidence that hubs can address structural inequalities by widening access to digital tools and entrepreneurial training (Hammond et al. 2020; Herrington & Coduras 2019). However, the African experience goes further in positioning DIHs as safe and enabling spaces where marginalised groups can acquire legitimacy and confidence as entrepreneurs (Abrahams 2021; Lusweti & Omieno 2023). This finding extended global debates by emphasising the social inclusivity dimension of DIHs, which has received less attention in studies from the Global North.

The results also highlighted the ecosystem brokerage role of DIHs. By connecting startups with funders, corporates, government agencies and universities, hubs act as integrators of fragmented innovation systems. This supported European findings on DIH networking and acceleration functions (Crupi et al. 2020; Sassanelli et al. 2021). The African data revealed an additional dimension, namely digital clustering, where virtual platforms substitute for geographic proximity. This extended Cluster Theory by demonstrating how DIHs replicate agglomeration benefits in resource-constrained environments, offering a more inclusive model of clustering adapted to dispersed African geographies (Porter 2000; Spigel & Harrison 2018).

Furthermore, the study highlighted DIHs' ecosystem-building capacities through policy alignment and stakeholder partnerships, positioning them as key vehicles for implementing national strategies and regional frameworks such as AfCFTA (AfriLabs & Briter Bridges 2019; Gumbo & Moos 2024). Thus, collaboration with academia enhances student employability while stimulating applied, locally relevant research.

Importantly, the study confirmed that DIHs contribute to immediate economic outcomes such as job creation and revenue growth, echoing broader claims about entrepreneurship and development (Acs, Szerb & Lloyd 2018; Urbano et al. 2019). However, it also highlighted uneven performance across startups, with some ventures scaling rapidly while others remain fragile. This unevenness mirrored concerns in both African and European studies, particularly that impact measurement is weak and overly reliant on basic indicators such as job counts (Hervás Oliver et al. 2021; Mhlongo & Mzyece 2023). By surfacing these disparities, the study contributed to calls for more robust, context-specific metrics that capture long-term survival, innovation outputs and social value.

Taken together, the findings advanced theoretical and practical debates. Theoretically, the study confirmed the utility of KSTE, Institutional Theory and Cluster Theory. It further extended them by showing how DIHs facilitate unintentional knowledge diffusion, legitimise startups in contexts of weak formal institutions and create digitally mediated clusters that broaden participation (Crupi et al. 2020; Ferreira et al. 2017; Porter 2000). Practically, the research illustrated that DIHs are more than digital support centres; they are institutional innovations capable of derisking fragile entrepreneurial environments, embedding inclusive practices and aligning entrepreneurship with sustainability and policy priorities. Their long-term contribution, however, hinges on sustained investment, localisation and coherent policy frameworks that move beyond donor-driven models and embed DIHs within national and regional development strategies (Hervás Oliver et al. 2021; Mhlongo & Mzyece 2023).

Despite their promise, DIHs' impact remains uneven, shaped by local contextual factors, weak national innovation systems, inconsistent policies and donor-dependent models (AfriLabs & Briter Bridges 2019; Atiase et al. 2020; Mhlongo & Mzyece 2023). In addition, their concentration in urban centres risks reinforcing digital divides unless deliberately extended to rural and underserved areas. Ensuring DIHs' sustainability and systemic impact requires localisation, institutional resilience and embedded impact assessment mechanisms. To scale their contribution, stakeholders must move beyond pilot models and institutionalise DIHs within coherent innovation and inclusive development policies.

Limitations of the study

While this study provided valuable insights into the role of DIHs in Africa's entrepreneurial and innovation ecosystems, several limitations should be acknowledged. Firstly, the study employed a qualitative design focused on a purposive sample of DIH managers and startup founders, which, while rich in depth, may limit the generalisability of findings across all African DIHs. Secondly, the analysis centred primarily on DIHs affiliated with the AEDIBNet initiative, which may represent more structured or better-resourced hubs compared to less formalised or community-based innovation spaces. Thirdly, the reliance on self-reported data through interviews may introduce subjective biases, particularly regarding perceptions of impact and success. Lastly, the study's geographic representation, while diverse, was not exhaustive, and future research could benefit from a more comprehensive regional spread and inclusion of longitudinal data to assess long-term outcomes of DIHs. Addressing these limitations in future studies will strengthen the empirical base for understanding the systemic value and sustainability of DIHs across Africa's evolving digital economy.

Future studies

Building on the findings of this study, future research should explore the longitudinal impact of DIHs on startup sustainability, job creation and regional development across diverse African contexts. Quantitative or mixed-methods approaches could complement the current qualitative insights by measuring outcomes such as venture survival rates, revenue growth and innovation diffusion. Furthermore, comparative studies between urban and rural-based DIHs would offer a nuanced understanding of spatial dynamics in innovation access and inclusion. Scope also exists to deepen theoretical contributions by examining how emerging constructs such as digital legitimacy, hybrid governance and inclusive innovation metrics evolve within DIH ecosystems. Moreover, policy-focused research could investigate how national innovation strategies and regional frameworks, such as AfCFTA, can better integrate and support DIHs as formal institutions. Expanding the analysis to include community-driven hubs and informal innovation networks will further enrich the understanding of Africa's innovation landscape and the contextual adaptability of DIH models.

Contribution

This article contributed to the growing scholarship on entrepreneurship and innovation ecosystems in Africa by providing empirical insights into the evolving role of DIHs in promoting inclusive and sustainable entrepreneurship. It advanced contextual understanding by showing how DIHs in Africa are being adapted to address persistent challenges such as digital exclusion, youth unemployment and informal entrepreneurship. Drawing on evidence from 12 DIHs under the AEDIBNet initiative, the study highlighted how these hubs function as context-responsive mechanisms that integrate digital capability building, mentorship and ecosystem linkages within resource-constrained environments.

Theoretically, the article integrated KSTE, Institutional Theory and Cluster Theory into a unified framework. It offered a robust lens to explain how DIHs operate as ecosystem nodes that enable knowledge exchange, confer legitimacy and foster both physical and digital clustering. By grounding these theories in African contexts, the study extended their applicability to digitally mediated, resource-constrained environments.

Practically, the study identified emerging lessons for policymakers, ecosystem builders and development partners. The findings pointed to the importance of public-private collaboration, alignment with continental frameworks such as AfCFTA and sustainable funding models that strengthen the long-term viability of DIHs. In addition, the evidence underscored the value of gender responsive and socially inclusive approaches that expand participation and ensure equitable access to digital and entrepreneurial opportunities.

Finally, the study enriched multidisciplinary innovation literature by capturing the perspectives of DIH managers and startup founders. This illustrated how DIHs drive entrepreneurship, digital transformation and cross-sector collaboration. In doing so, the article positioned DIHs not only as digital support centres but as institutional innovations central to reshaping Africa's entrepreneurial and economic trajectory.

Conclusion

This study provided empirical evidence on the transformative role of DIHs in advancing entrepreneurship and economic growth across Africa. Insights from 12 AEDIBNet-affiliated DIHs revealed that these hubs function as strategic enablers of inclusive innovation, ecosystem strengthening and institutional development, addressing systemic entrepreneurial challenges prevalent in fragmented and under-resourced ecosystems. In addition, DIHs play a critical role in promoting inclusive economic participation by empowering women, youth and marginalised groups, while enhancing ecosystem integration through connections to markets, policy platforms and global innovation networks.

Theoretically, the study contributed an integrated framework combining KSTE, Institutional Theory and Cluster Theory, offering a nuanced understanding of how DIHs foster knowledge exchange, legitimacy and collaborative growth within African innovation ecosystems. This hybrid model is particularly relevant in contexts where institutional frameworks are evolving, and digital platforms extend innovation beyond traditional boundaries. However, the study also identified the need for coherent policy alignment, sustainable financing and robust impact assessment mechanisms to embed DIHs within national and regional development strategies. With such support, DIHs can emerge as cornerstone institutions for Africa's digital transformation, driving entrepreneurship, fostering inclusive development and enhancing the continent's global competitiveness.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

CRedit authorship contribution

Edwell Gumbo: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Visualisation, Writing – original draft, Writing – review & editing. Menisha Moos: Supervision. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication, and take responsibility for the integrity of its findings.

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Data availability

The data that support the findings of this study are openly available from the University of Pretoria research data management platform at https://researchdata.up.ac.za/authors/Edwell_Gumbo/18979616.

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